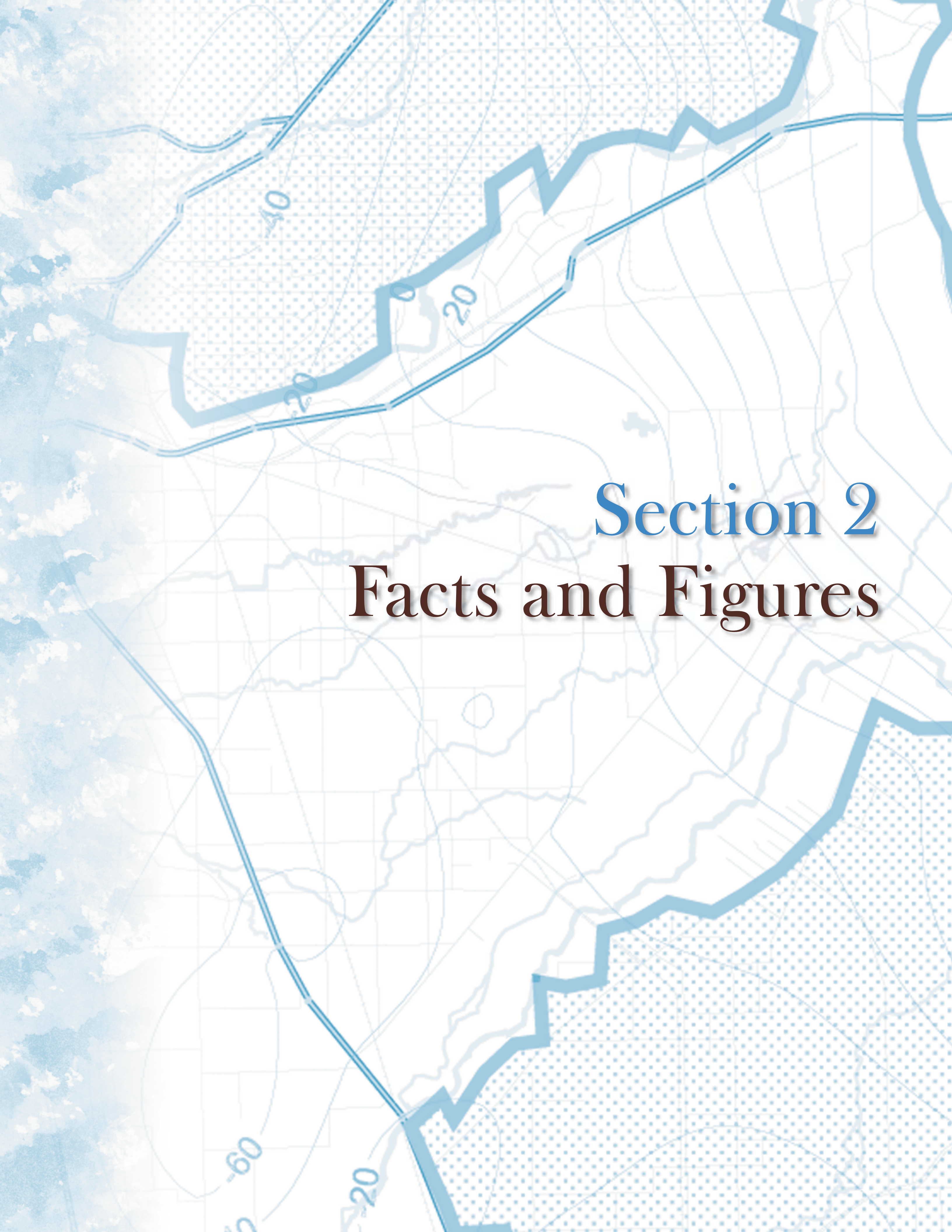


# Section 2
# Facts and Figures

# Facts and Figures

Section 2

This section describes the Water Forum Agreement, which provides for developing a groundwater management program in the Central Basin. Advantages and disadvantages of groundwater management are listed, and important groundwater terms and concepts are discussed.

## *Water Forum Agreement*

The Water Forum Agreement was negotiated over 6 years by the Water Forum, a diverse group of business and agricultural leaders, citizen groups, environmentalists, water managers, and local governments in the Sacramento region. The Water Forum Agreement has two coequal objectives: 1) to provide a reliable and safe water supply for the region's economic health and planned development through 2030, and 2) to preserve the fishery, wildlife, recreational, and aesthetic values of the Lower American River.

The Water Forum also negotiated recommendations for sustainable yield (the amount of groundwater that can be safely pumped from a basin on a long-term average annual basis without damaging the aquifer) for the north, central, and south (Galt) area groundwater subbasins in Sacramento County. (Sustainable yield for the Central Basin is discussed at the end of this section.)

The groundwater management element of the Water Forum Agreement outlines groundwater management recommendations for the Sacramento North Area Groundwater Management Authority, now known as the Sacramento Groundwater Authority (SGA), which manages groundwater in the north area subbasin. (These recommendations are not a "template" to be imposed on the Central Basin.)

In addition, the Water Forum Agreement calls for an interest-based negotiation process to allow all parts of the community to participate in developing groundwater management measures for the Central Basin. This stipulation in the Water Forum Agreement led to creation of the CSCGF under the sponsorship of the Water Forum Successor Effort.

**Water Forum Agreement**
An agreement negotiated over 6 years by a diverse group of stakeholders in the Sacramento region.

**Water Forum**
Diverse group formed to develop and implement a plan to ensure the region's water supply needs to 2030 while preserving the ecosystem of the Lower American River.

**sustainable yield**
The amount of groundwater that can be safely pumped from a basin on a long-term average annual basis without damaging the aquifer.

**SGA**
Sacramento Groundwater Authority
The groundwater management element of the Water Forum Agreement led to creation of the SGA. This agency is responsible for managing groundwater in the north area subbasin of Sacramento County.

**Water Forum Successor Effort**
This group was formed after the Water Forum Agreement was signed to carry forward the agreement and address changed conditions. Members of the group represent stakeholders who signed the Water Forum Agreement.

## *Advantages/Disadvantages of Groundwater Management*

Without viable groundwater management measures, Central Basin stakeholders can expect:

- **Declining groundwater levels**
- **Increased pumping costs**
- **Accelerated movement of toxic plumes**
- **Increased water treatment costs**
- **Possible permanent damage to the groundwater aquifer**
- **Further reduction in flow for the Cosumnes River and other rivers and streams in the Central Basin**

With an agreed-on groundwater management plan that achieves a sustainable yield, stakeholders can:

- **Stabilize groundwater levels**
- **Maintain water quality**
- **Ensure long-term viability of the groundwater aquifer**
- **Meet existing and future water demands**
- **Coordinate with and support Cosumnes River restoration efforts**

**Figure 1** illustrates historic groundwater elevations near the cone of depression. Stabilized groundwater elevations are projected through 2030, with and without groundwater management.

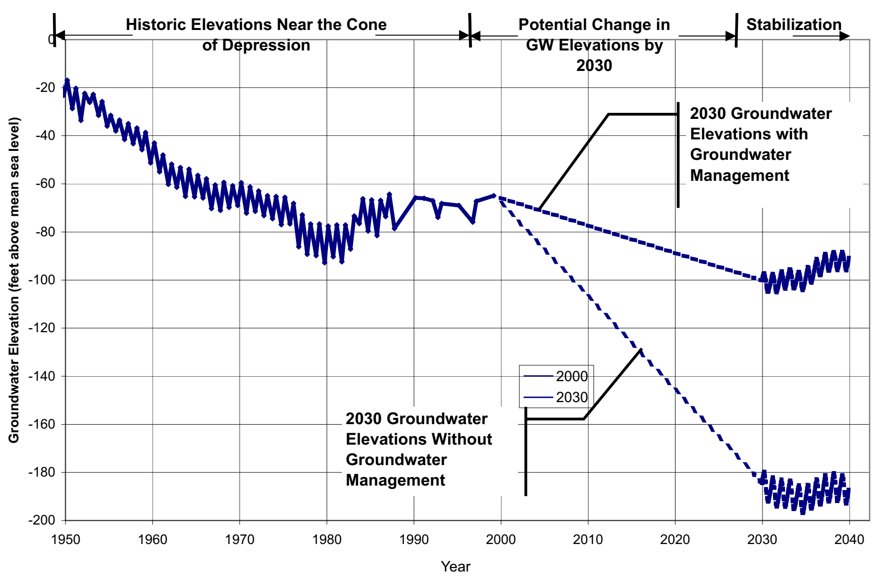



*Figure 1. Example of Estimated Benefits from Groundwater Management for the Central Basin*

## *Primer of Groundwater Terms and Concepts*

To discuss groundwater management, it is helpful to know and understand general groundwater terms and concepts, and information specific to the Central Basin. The remainder of this section contains educational material presented in CSCGF meetings, and other relevant facts and figures.

# Central Basin

## Where is the Central Basin?

**hydrology**
Science that deals with the properties, distribution, and circulation of water on and below the earth's surface and in the atmosphere.

**hydrogeology**
Science that deals with subsurface waters and related geologic aspects of surface waters.

**watershed**
Region that is drained by, or contributes to, streams, lakes, rivers, or other bodies of water.

For purposes of groundwater management, the Water Forum divided the groundwater basin in Sacramento County into three subbasins: north, central, and south (Galt), as shown in **Figures 2 and 3**. The subbasin in the central area of the groundwater basin, known as the "Central Basin," lies south of the American River, east of Interstate 5 and the Sacramento River, and north of the southern boundary of the Omochumne-Hartnell Water District and the Cosumnes River. The eastern boundary of the Central Basin is approximately 5 to 6 miles west of the Sacramento County-El Dorado County border, where the Sierra Nevada foothills begin to rise up from the Central Valley floor.

The Central Basin falls within the 27,000-square-mile Sacramento River Watershed, one of the largest watersheds in the United States, draining the Sacramento Valley, Modoc Plateau, and parts of the Cascade Range and Sierra Nevada Range.

**DWR Groundwater Basins**

Based on **hydrology** and **hydrogeology**, DWR has identified and numbered the groundwater basins in California, including the basin in Sacramento County:

- Name: Sacramento Valley Groundwater Basin
- Groundwater Basin Number: 5-21.65
- Surface Area: 248,000 acres (388 square miles)

DWR has also named subbasins within Sacramento County: the "Central Basin" lies within the South American Subbasin of Basin Number 5-21.65.

Source: DWR, 2003

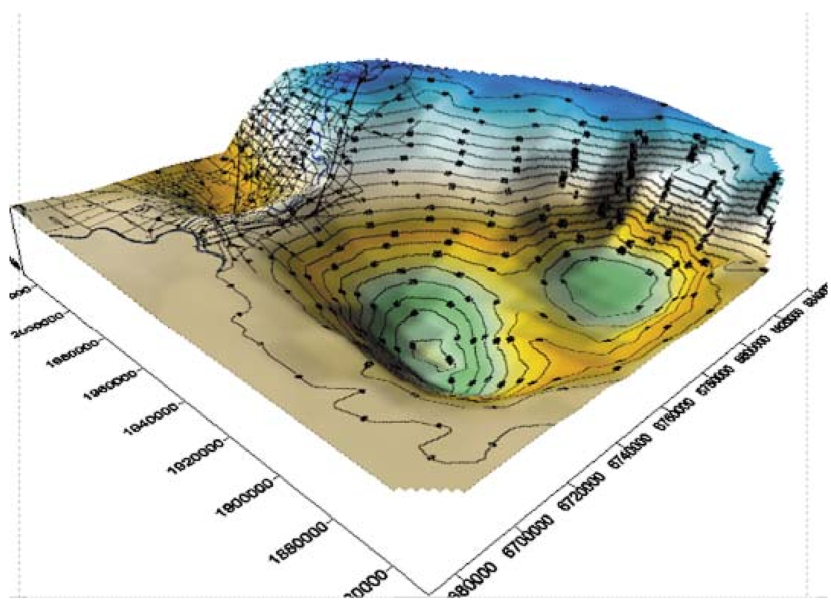


*Figure 2. Three-Dimensional Representation of Sacramento County Groundwater Subbasins*

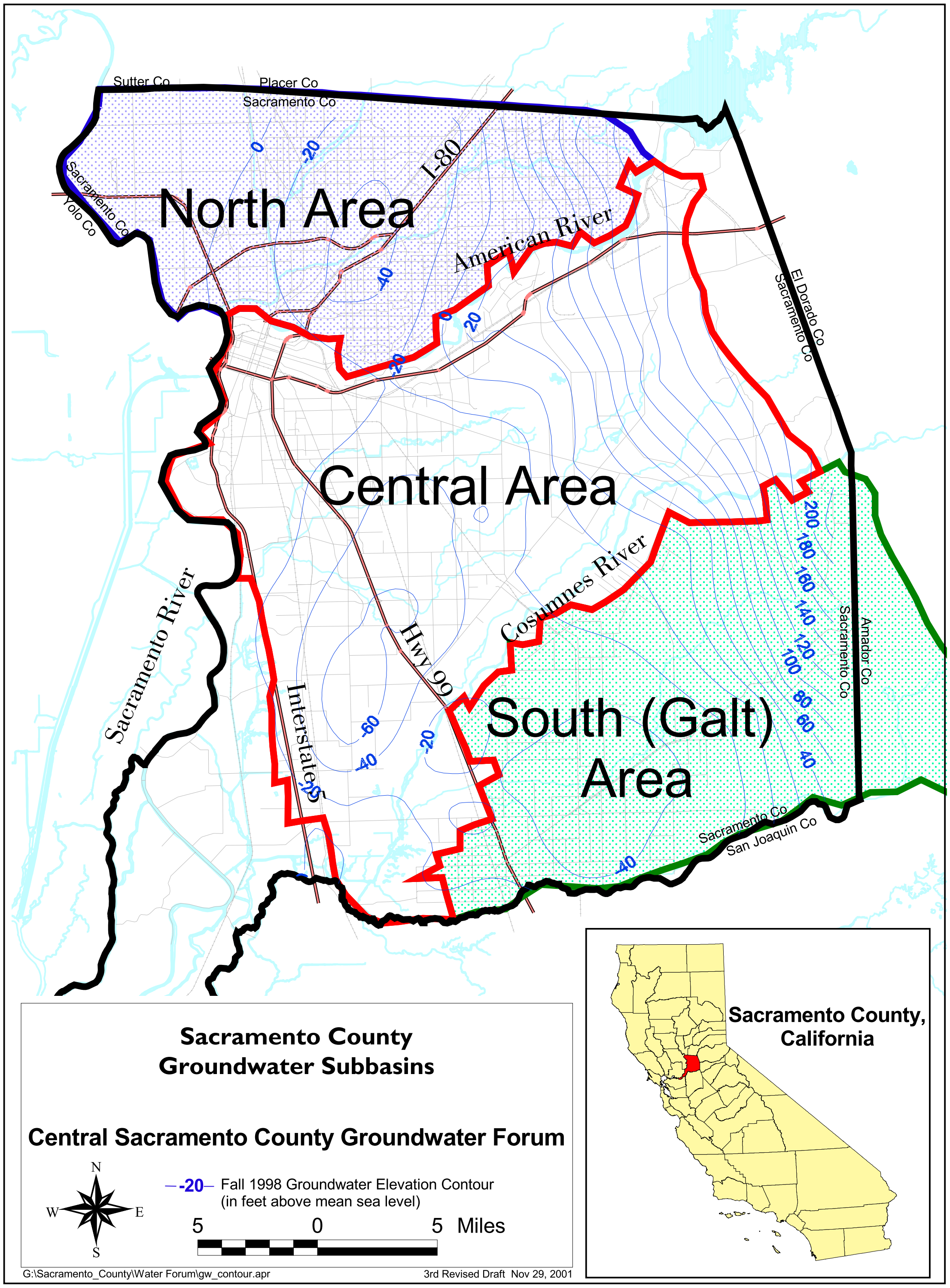



*Figure 3. Location of Groundwater Subbasins in Sacramento County*

# Groundwater

## How does a basin hold groundwater?

**groundwater**
Water stored in the pore spaces of rocks or unconsolidated deposits found in the saturated zone of an aquifer.

**consolidated rock**
Mineral particles of different sizes and shapes that have been welded together into a solid mass by heat and pressure or chemical reactions. Examples of rocks important for groundwater include limestone, dolomite, shale, siltstone, sandstone, and conglomerate.

**unconsolidated deposit**
Material consisting of particles of rocks or minerals ranging in size from clay to boulders. Examples of unconsolidated deposits important for groundwater are clay, silt, sand, gravel, and cobble (in order of increasing grain size).

**alluvial deposit**
Clay, silt, sand, gravel, or cobble deposited by rivers and streams over long periods of time.

**porosity**
Volume of open pore space between particles of clay, silt, sand, gravel, or cobble in a geologic formation, usually expressed as a percentage.

**geologic formation**
Set of rocks or unconsolidated deposits that forms a unit and may be dominated by a certain type of deposit or rock, or may have some other common feature.

Because groundwater is hidden from view below the earth's surface, it is not always well understood. Groundwater does not occur in underground streams or rivers; instead, it is stored in the pore spaces of some kinds of consolidated rocks (rocks) and unconsolidated deposits. Examples of rocks that can store water are limestone, shale, and sandstone. Most unconsolidated deposits come from the disintegration of rocks, which yields minerals or rock particles that can vary widely in size. Unconsolidated deposits that are water-bearing include clay, silt, sand, gravel, and cobble. When these deposits are laid down by flowing water (streams or rivers) over a long time, they are called alluvial deposits. Some rocks or unconsolidated deposits have more or larger pore spaces (porosity) than others and can hold more water.

A geologic formation is a set of rocks or unconsolidated deposits that forms a unit and may be dominated by a certain type of rock or deposit, or may have some other common feature. Some geologic formations occur in layers and others are very heterogeneous and discontinuous in nature, such as the alluvial deposits of the Central Basin.

# *Groundwater (cont'd)*

**aquifer**
Geologic formation that is water-bearing and permeable and yields economically significant amounts of water to wells or springs.

**permeability**
For groundwater, the ability of a rock or unconsolidated deposit to transmit water through spaces that connect between grains. The size and shape of the spaces controls how well water transmits or "flows." Usually expressed in millidarcies.

**semipermeable**
In a formation, having small preferential flow paths through mostly impermeable material.

An aquifer is a geologic formation that is water-bearing and permeable, which means the spaces between the grains must connect so that groundwater can "flow" between and thus be yielded or "transmitted" to wells and springs. The size and shape of the pore spaces controls the ability of the deposits to transmit groundwater (**Figure 4**). Permeability can vary greatly, ranging from highly permeable unconsolidated deposits, such as gravels, to silts and clays, which have low permeability. Semipermeable formations have small, preferential flow paths for groundwater through mostly impermeable material.

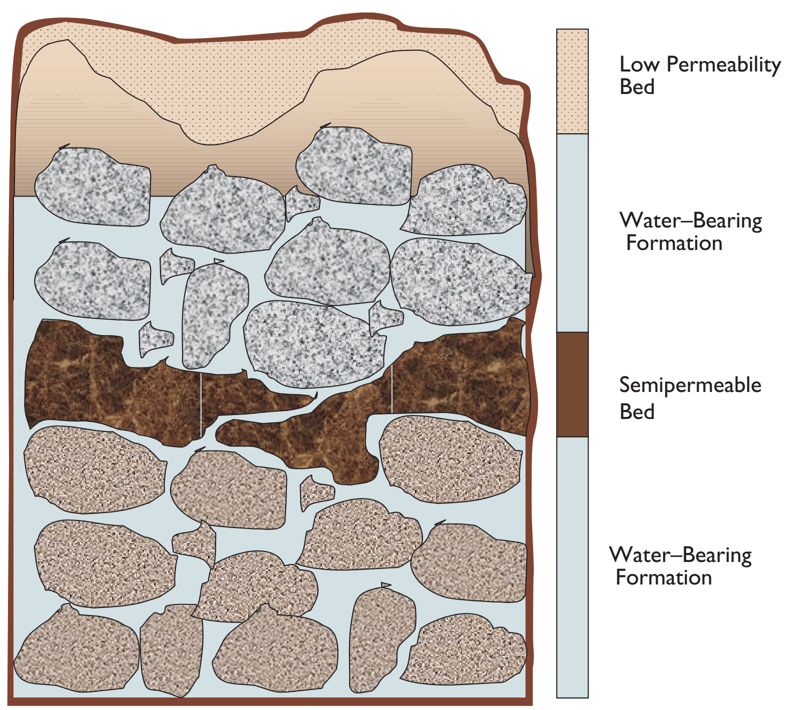



*Figure 4. Elements of an Aquifer*

# Groundwater (cont'd)

Above aquifers are unsaturated zones, which lie just below the land surface and contain both air and water; water in unsaturated zones is referred to as subsurface water. Aquifers are saturated, meaning only water is present in the interconnected spaces, and only this water in the saturated zone is correctly termed groundwater. Between the unsaturated and saturated zones of an aquifer lies a transition zone. The water table is the level in the saturated zone where pressure from the air and pressure from the water are equal (**Figure 5**).

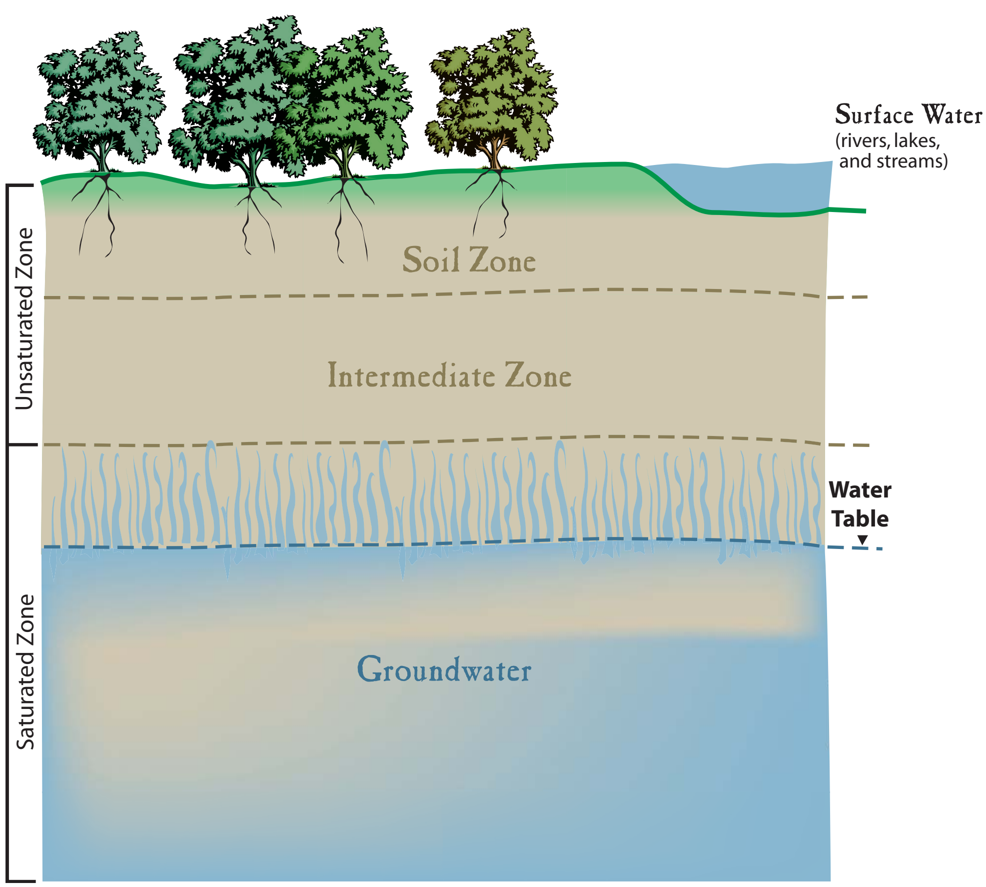



*Figure 5. Saturated and Unsaturated Zones in an Aquifer*

**unsaturated zone**
Zone that lies just below the land surface and contains both air and water.

**subsurface water**
Water under the surface of the earth.

**saturated zone**
Zone with only water in the interconnected spaces.

**transition zone**
Lies between the unsaturated and saturated zones of an aquifer.

**water table**
Level in the saturated zone of an aquifer where the pressure from the air and the pressure from the water are equal. In an unconfined aquifer, the water table is the top of the saturated zone and the bottom of the unsaturated zone.

# Groundwater (cont'd)

**unconfined aquifer**
Aquifer without a confining layer at the top; therefore, a corresponding lack of pressure allows the water level to rise or fall.

**confined aquifer**
Has a confining layer at the top, causing the groundwater to be under pressure.

Aquifers can be unconfined, confined, or semiconfined (**Figure 6**):

**Unconfined aquifer.** The level of water in an unconfined aquifer can rise or fall because there is no confining layer (layer with low permeability) at the top and the groundwater is not under pressure. In an unconfined aquifer, the water table is the top of the saturated zone and the bottom of the unsaturated zone. The water level in an unconfined aquifer well shows the level of the water table in the surrounding aquifer.

**Confined aquifer.** A confined aquifer has a confining layer at the top, causing the groundwater to be under pressure. Because of this pressure, the water level in a confined aquifer well is above the top of the aquifer, and sometimes even above the land surface.

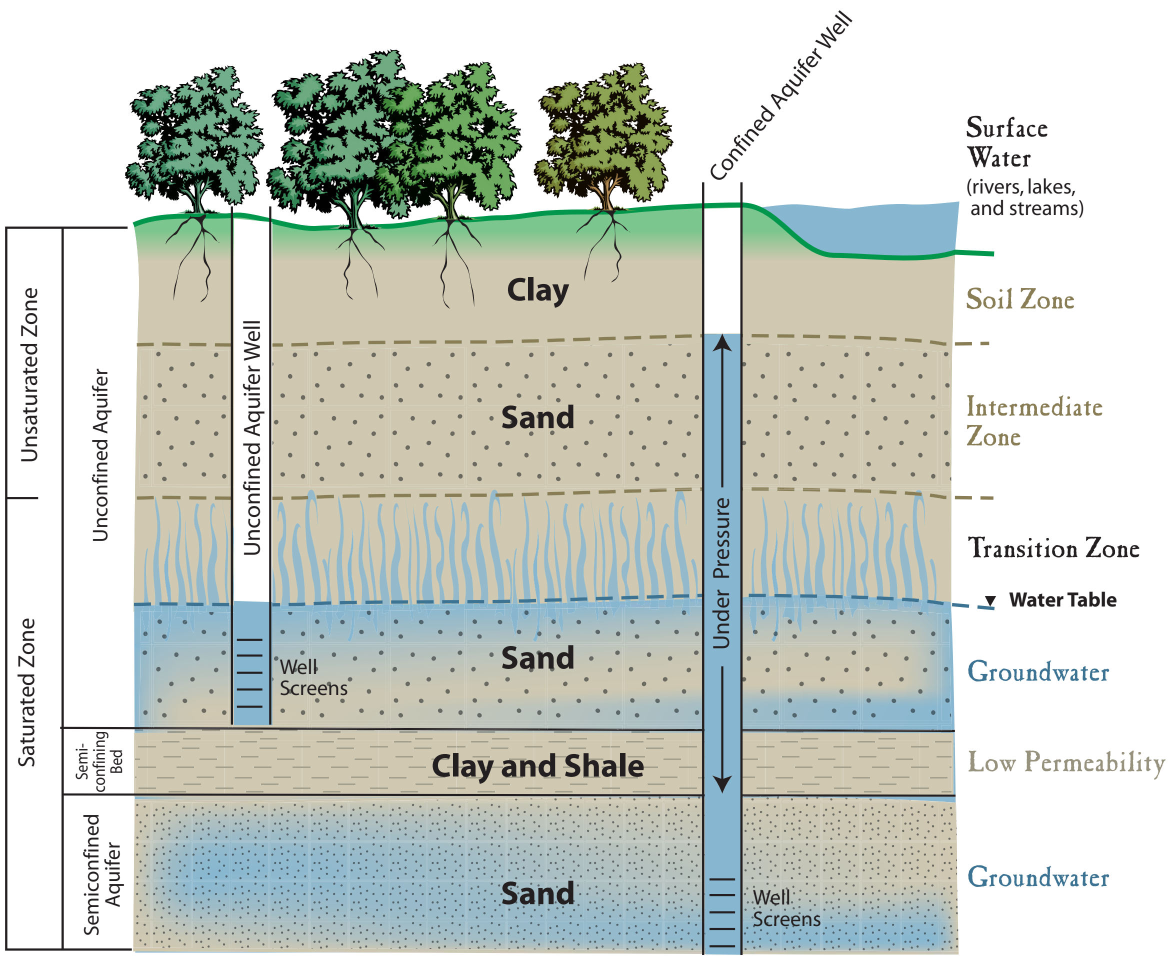



*Figure 6. Types of Aquifers*

# *Groundwater (cont'd)*

Semiconfined aquifer. Semiconfined aquifers are confined by upper layers with permeability that varies from low to moderate. Thus, groundwater moves through these confining layers, but moves slowly.

An aquifer system is a regional set of interbedded geologic formations within a groundwater basin. Some formations are very permeable and transmit water quickly and others have very low permeability and transmit water more slowly; however, the formations are water-bearing as a whole.

Aquifers and aquifer systems are found in groundwater basins, which are flow systems that have a surface and a subsurface area with defined boundaries, and materials that can store water.

Geologic formations that contain groundwater in the Central Basin include the Riverbank (formerly known as Victor) and Turlock Lake/Laguna (formerly known as Fair Oaks-Laguna) formations, which together make up an upper, unconfined aquifer system, and the Mehrten Formation, which is a lower, semiconfined aquifer system. These aquifer systems are typically composed of lenses of interbedded sand, silt, and clay interlaced with coarse-grained stream channel deposits; the layers form a wedge that generally thickens from east to west at a constant rate to a maximum thickness of about 2,000 feet under the Sacramento River (**Figure 7**).

The Central Basin is described as having an unconfined and semiconfined aquifer system. Groundwater wells in the Central Basin are generally 100 feet to 1,500 feet deep, and yield water from both the unconfined and semiconfined aquifer systems.

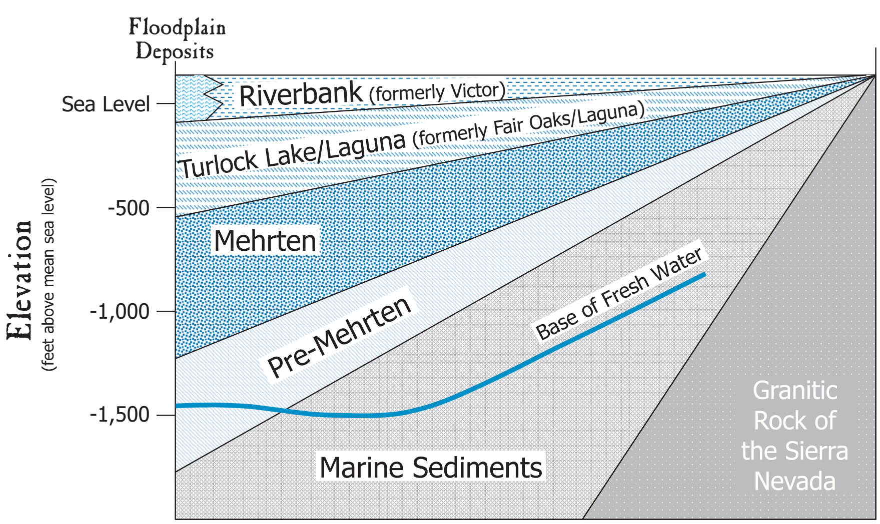



*Figure 7. Central Basin Geologic Formations*

**semiconfined aquifer**
Confined by upper layers having permeability that varies from low to moderate. Thus, groundwater moves through these confining layers, but moves slowly.

**aquifer system**
Regional set of interbedded geologic formations within a groundwater basin.

**interbedded**
Beds lying between or alternating with others of a different type.

**groundwater basin**
Flow system that has a surface and a subsurface area with defined boundaries, and materials (rocks or unconsolidated deposits) that can store water.

# Land Use

## How does land use relate to groundwater use in the Central Basin?

Historically, land in the Central Basin has been used for the following purposes:

- **Agricultural** (**"ag"**) – properties of more than 5 acres, typically used for row crops, vineyards, grazing, etc.
- **Agricultural-residential** (**"ag-res"**) – small farms or residential properties generally 5 acres or less
- **Municipal and industrial** (**M&I**) – urban or industrial development
- Conservation reserves and native lands – land along waterways and in other areas that is set aside and protected, and undeveloped land, respectively

In the past, ag activities were the primary land use in the Central Basin requiring water; groundwater supplied most of the water used by ag. Today, while much of the land in the Central Basin remains ag or ag-res property, M&I, formerly a minor land use category, has grown to be the Central Basin's largest land use requiring water supply (**Figure 8**).

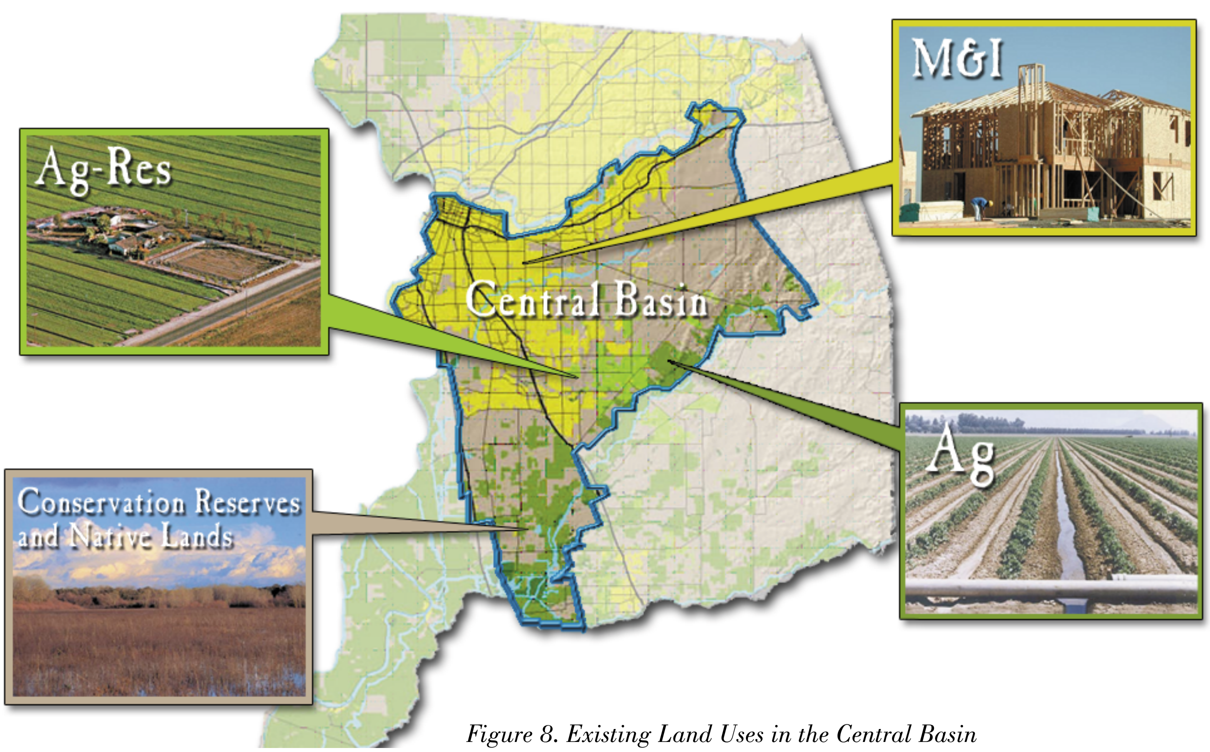



*Figure 8. Existing Land Uses in the Central Basin*

# Changes in the Central Basin

## How are land use and water demand changing in the Central Basin?

Sacramento County's 1993 General Plan, approved by the Sacramento County Board of Supervisors, provides for additional urban development within its Urban Policy Area to meet projected population growth until 2024. Other incorporated cities in Sacramento County also have approved similar General Plans to account for future development. **Figure 9** shows Sacramento County land uses projected for 2024 (the Water Forum adds 6 more years to this date, using 2030 for planning), including urban growth boundaries. The planning horizons of the General Plan and Water Forum Agreement recognize development of designated urban areas.

**General Plan**
Document used by Sacramento County and incorporated cities to plan for providing infrastructure for future development within identified boundaries.

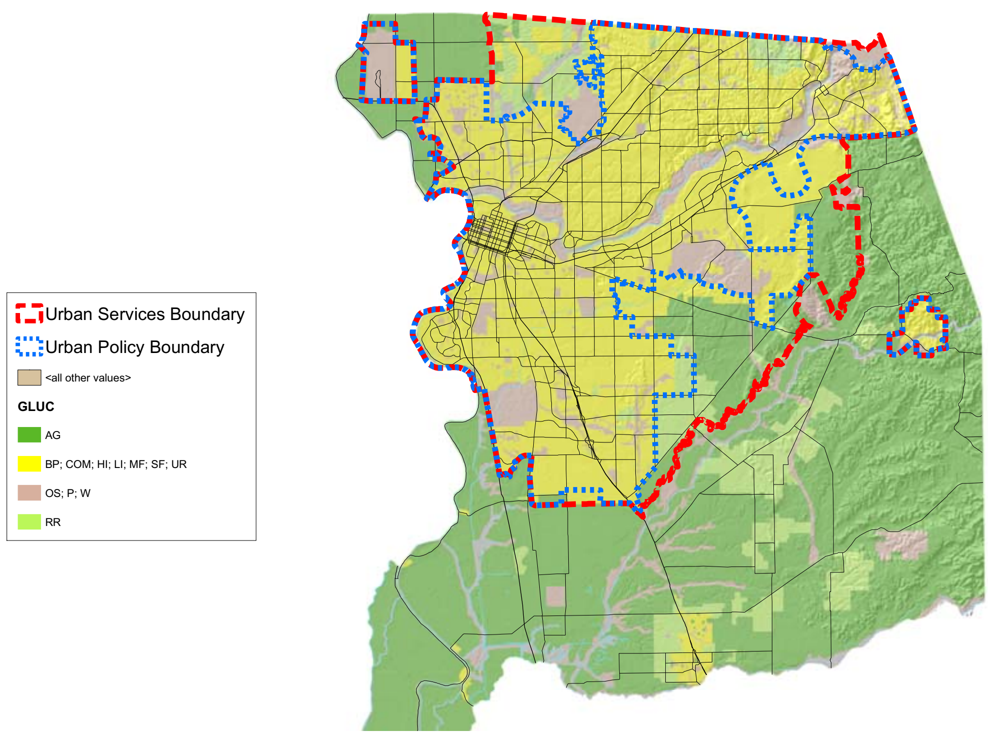



*Figure 9. Sacramento County Land Use and Approved General Plan Development Boundaries Projected for Development Through 2024.*

# *Changes in the Central Basin (cont'd)*

Given the adopted General Plans, the trend of converting ag and ag-res land to M&I uses will likely continue, with the population of the Central Basin projected to increase 52 percent by 2025, according to population projections of the Sacramento Area Council of Governments.

The Central Basin is served by 11 water purveyors (**Figure 10**); however, a large portion of the Central Basin is not served by any organized water purveyor. The unserved areas include over 6,000 self-supplied ag and ag-res groundwater users.

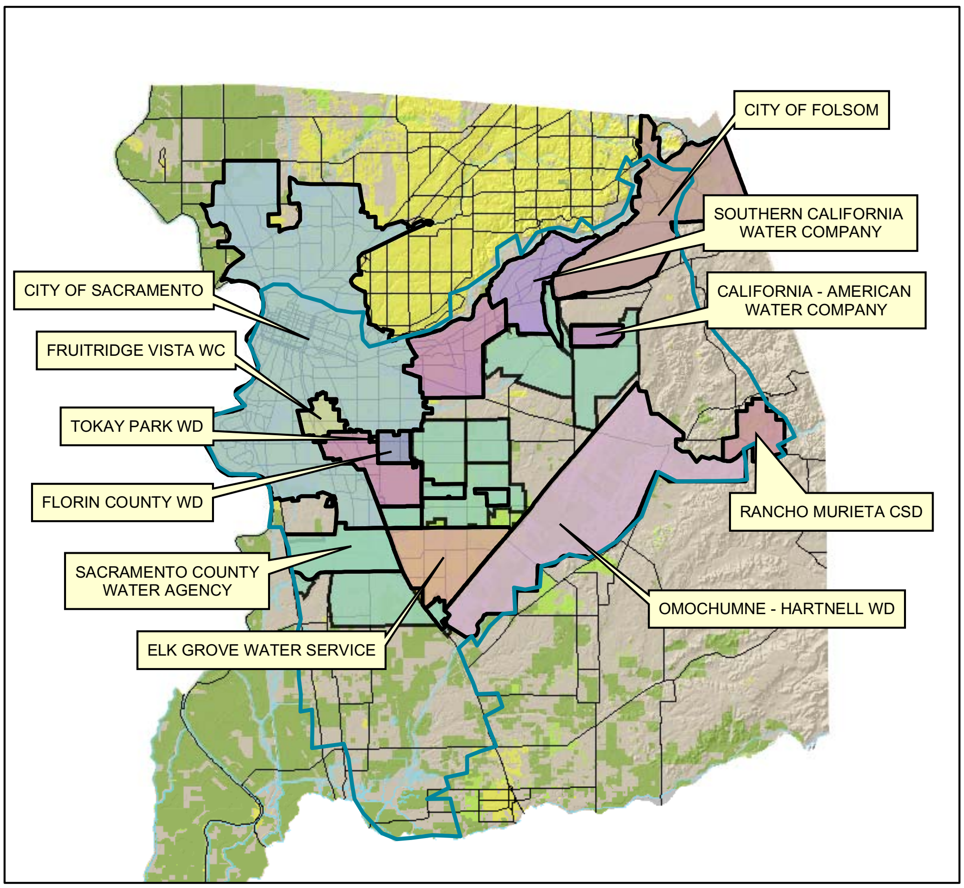



*Figure 10. Water District Service Areas Within the Central Basin*

# *Changes in the Central Basin (cont'd)*

Current acreages for ag, ag-res, M&I, and conservation land uses in Sacramento County are shown in **Table 1** with acreages for development through 2024 and net increases/decreases in acreage.

About two-thirds of the water used in the Central Basin area comes from groundwater. While water use varies based on annual weather conditions, in 1990 about 250,000 acre-feet of groundwater were pumped for ag, ag-res, M&I, and environmental uses. **Figure 11** shows historical groundwater pumping for ag, ag-res, and M&I uses in the Central Basin. Looking into the future, under the provisions of the currently approved General Plan, significant increases will occur for M&I demand.

**acre-foot**
Amount of water it takes to cover an acre of land to a depth of 1 foot; about 326,000 gallons. An acre-foot can supply the annual needs of between one and two average California households.

*Table 1. Current and Projected Land Use in Sacramento County*

| Land-Use Category | Current Conditions 2000 (acres) | General Plan Development Through 2024 (acres) | Net Increase or Decrease (acres) |
|---|---|---|---|
| Ag | 53,269 | 45,054 | -8,215 |
| Ag-Res | 5,418 | 21,144 | +15,726 |
| M&I (urban) | 80,398 | 116,042 | +35,644 |
| Conservation Reserves and Native Lands[1] | 108,101 | 64,946 | -43,155 |
| Total Area | 247,186 | 247,186 | 0 |

*[1]Native land is undeveloped land (i.e., not urban, ag, etc.)*

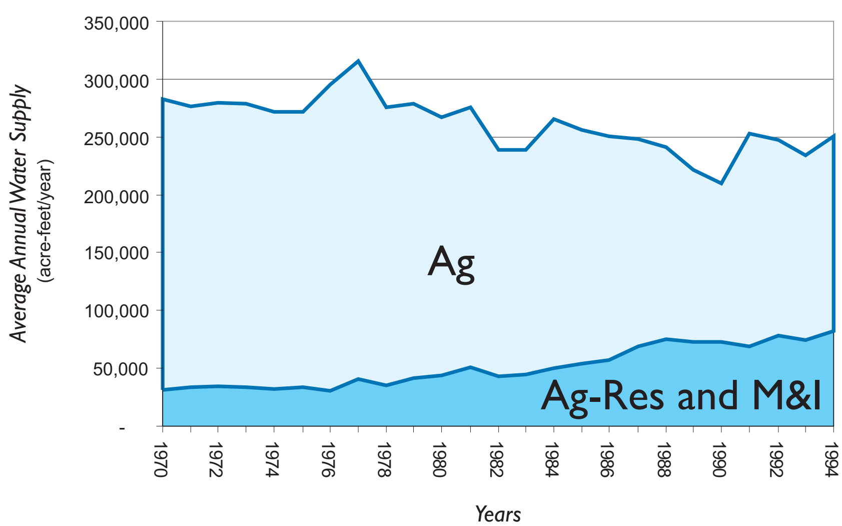



*Figure 11. Historical Pumping in the Central Basin*

# Conjunctive Use

## What is conjunctive use?

Groundwater can supplement surface water supplies, and through conjunctive use of both, a reliable water supply can be maintained. The estimated mix of surface water and groundwater in 1995 for the Central Basin (based on a Sacramento County groundwater model) was 60,000 acre-feet/year and 215,000 acre-feet/year, respectively. **Figure 12** illustrates where surface and groundwater are used separately or together (conjunctive operation) in the Central Basin.

**surface water**
All waters on the surface of the earth, including fresh water (streams, rivers, lakes), saltwater, ice, and snow.

**conjunctive use**
Coordinated management of surface water and groundwater supplies to increase the yield of both. Conjunctive use is intended to increase total supplies and enhance water supply reliability.

**conjunctive operation**
The operation of a groundwater basin in combination with surface water. Groundwater is stored in the basin for later use by intentionally recharging the basin during years of above-average surface water supply.

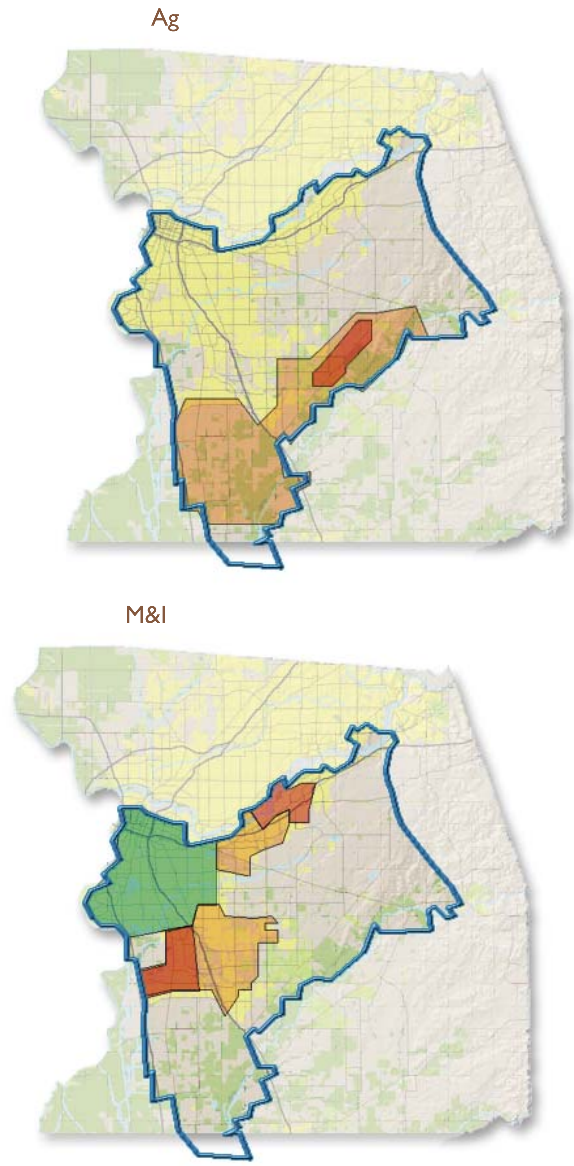



*Figure 12. Groundwater and Surface Water Used Separately and Conjunctively in the Central Basin*

*Surface Water*

*Groundwater*

*Conjunctive Use of Surface Water/Groundwater*

# Basin Recharge

## How is a basin recharged?

**recharge**
When water reaches the saturated zone of an aquifer, where it is available for extraction.

**surface water recharge**
Recharge from rainfall that percolates down to aquifers, and from rivers and streams that may or may not be connected to the water table. Surface water is always recharging groundwater. One result of this continuous recharge is that groundwater can be contaminated from land use practices at the surface.

**percolation**
Movement of water through small openings (pore space) within a porous material.

**hydraulic connection**
When surface water and groundwater are connected (allows groundwater to be recharged). Can also refer to a connection between two aquifer zones.

**mountain front recharge**
When precipitation and runoff enter geologic formations that are exposed along the front of mountains and this water travels into aquifers via the formations.

**atificial recharge**
When surface water is added to a groundwater basin by human activity.

**surface spreading basin**
Basin above an aquifer that is filled with water in areas of good percolation.

**dual-purpose well**
Groundwater well that is used for both extraction and injection.

**in-lieu recharge**
Indirect method of recharge - groundwater users use excess surface water in lieu of groundwater.

**cone of depression**
A depression of the water table surface in the shape of an inverted cone. Localized cones of depression develop around a well or wells that are being pumped. Regional cones of depression occur from long-term pumping in a groundwater basin.

Before any pumping occurs, a groundwater basin is in a state of equilibrium, or balance. In this state, groundwater tends to move slowly from points of entry (known as recharge areas) to points of exit (discharge areas). (The approximate rate of groundwater movement in the Central Basin is 200 feet to 1,500 feet per year and groundwater levels fluctuate gradually during "wet" and "dry" periods.) The basin is recharged, or refilled, by several methods:

- Surface water recharge from rainfall that percolates down to aquifers, and from rivers and streams that may or may not be connected to the water table (hydraulic connection).
- Mountain front recharge, when precipitation and runoff enter geologic formations that are exposed along the front of mountains and this water travels into aquifers via the formations.
- Artificial recharge, which occurs as a result of human activity. Types of artificial recharge include filling surface spreading basins above aquifers with water in areas of good percolation, using dual-purpose wells to inject water as well as extract it, using recycled water for recharge, and practicing in-lieu recharge, an indirect method of recharge (groundwater users use excess surface water in lieu of groundwater).

It is only through long-term persistent pumping that groundwater elevations change over time. When a well is drilled into a basin, water is initially extracted from aquifer storage around the well, creating a localized cone of depression that moves up and down with well operations. Over time, the well creates a small incremental decline in the overall groundwater basin, increasing recharge, or refill, from rivers with a hydraulic connection to the water table. Regional pumping creates greater declines in an overall groundwater basin, as shown in **Figure 13** for the Central Basin.

# Basin Recharge (cont'd)

**overdraft**
Over a period of years, withdrawing from an aquifer (on purpose or inadvertently) more water than the amount of water recharging a basin.

To achieve recharge, and refill the basin, enough recharge water must be available to balance the groundwater system. If more water is pumped than is available for recharge, the basin enters a state of "**overdraft**." The period of time needed to balance the groundwater system between pumping and recharge is typically measured in decades.

Changes in the groundwater surface elevation result from changes in groundwater recharge, discharge, or extraction. In some instances within the Central Basin, this movement can induce natural recharge at locations where the river and aquifer are hydraulically connected, as shown in Figure 13a. To the extent that a hydraulic connection exists, as groundwater conditions change, the slope or gradient of the groundwater surface away from the river may change as well. A steeper gradient away from the river can induce additional recharge from the rivers. The rate of recharge from rivers that are hydraulically disconnected from the groundwater surface is indifferent to changes in groundwater elevations or gradient. This is typically true with smaller streams where the groundwater surface is located far below the streambed. In such cases, surface water percolates through the unsaturated zone to the groundwater and is a function of the aquifer materials underlying the streambed. As mentioned above, the rate of infiltration under these conditions is not governed by the gradient of the underlying groundwater. There is also some evidence to suggest these conditions exist along the Cosumnes River.

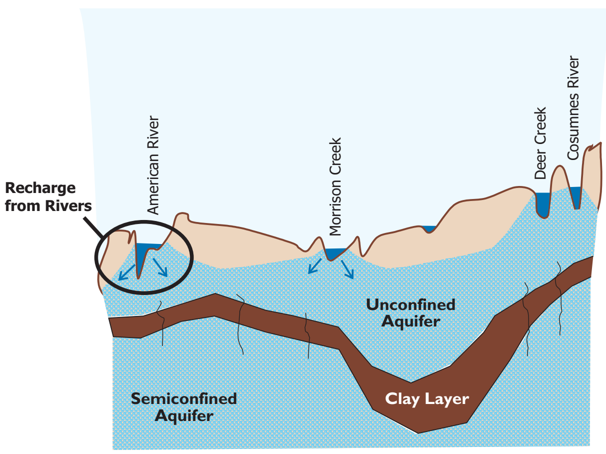



*Figure 13a. Prior to pumping: groundwater flow through the basin equals the rate of recharge from rivers, streams, and precipitation.*

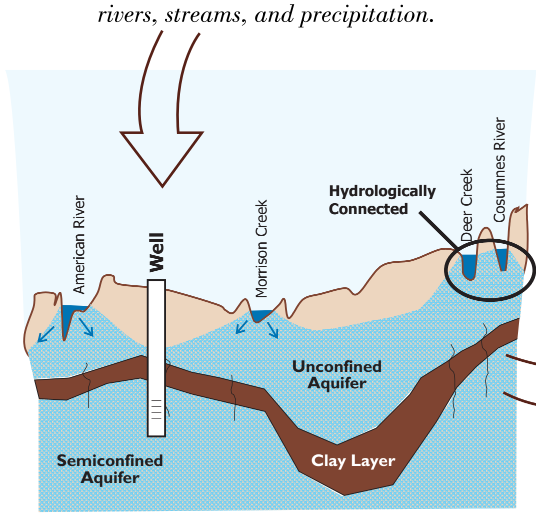



*Figure 13b. Single well: localized cone of depression near pumping well.*

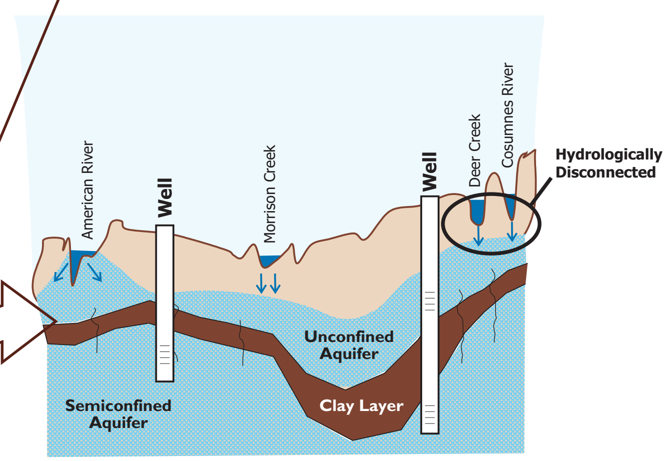



*Figure 13c. Regional pumping: regional reduction in groundwater elevation.*

*Figure 13. Effects of Pumping in the Central Basin*

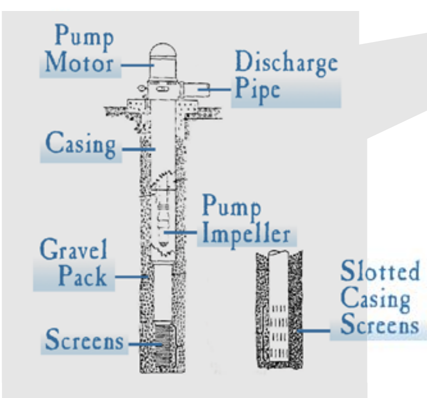
# Extracting Water

## How is groundwater taken out of the Central Basin?

Groundwater wells are used to pump water from the aquifers of the Central Basin. Wells are drilled from 100 feet to 1,500 feet deep and are owned by both public and private users. Various amounts of water are pumped to serve ag, ag-res, and M&I customers of organized water districts. The type of user typically dictates the location of a well and its depth of extraction. Well characteristics for each groundwater user group are listed in **Table 2** and shown in **Figure 14**, along with a diagram of how a typical groundwater well is constructed.

*Table 2. Well Characteristics for Central Basin Groundwater Wells*

| Well Type | Diameter (inches) | Depth (feet) | Capacity (gallons per minute) | Approx No. |
|---|---|---|---|---|
| Ag-Res | 4-8 | 191-300 | 344 | 4,950 |
| Ag | 12-16 | 60-600 | 970 | 320 |
| M&I | 12-16 | 400-1,000 | 400-2,000 | 160 |




*Elements of a typical groundwater well*

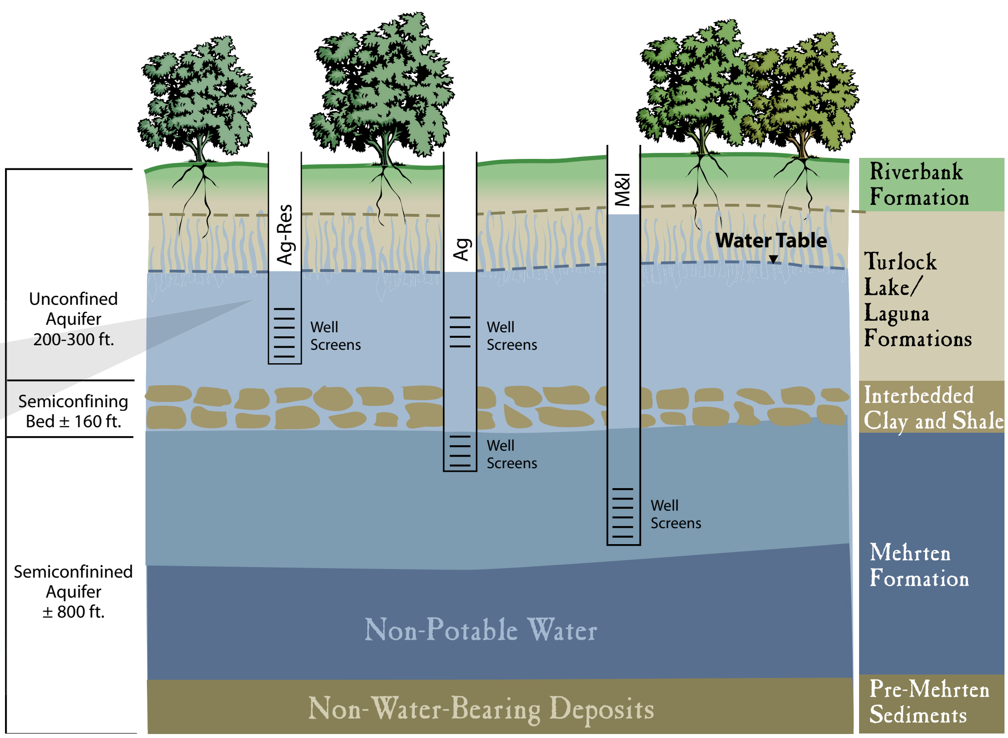



*Figure 14. Types of Groundwater Wells in the Central Basin According to Well Use*

# Sustainable Yield

## What is sustainable yield?

Sustainable yield is a balance between pumping and basin recharge and is expressed as the number of acre-feet of water per year that can be safely pumped from the basin on a long-term average annual basis without damaging the aquifer. The Water Forum Agreement contains a specific recommendation concerning sustainable yield for the Central Basin: 273,000 acre-feet/year. Pumping this amount will result in a further decline in groundwater levels of approximately 50 feet at the deepest point of the existing cone of depression. The following are important facts about the recommended sustainable yield for the Central Basin.

*Process used to determine sustainable yield:*

1. A baseline year was established (1990).
2. Baseline scenarios were developed to project changes in land use and water demands within the Water Forum 2030 planning horizon.
3. It was assumed that new urban growth outside surface water delivery areas would use only groundwater.
4. Impacts of increased groundwater extraction were investigated (impacts included groundwater quality degradation, number of wells affected, pumping costs, land subsidence, and contaminant plume movement).
5. To consider increased natural groundwater recharge from hydraulically connected streams and rivers, reduced flows in the American River were evaluated.

*Water Forum negotiations:*

1. Identified levels of acceptable impacts.
2. Considered availability of surface water and groundwater.
3. Considered economics (surface water costs, pumping costs, well replacement costs, and treatment costs).
4. Identified recharge from streams/rivers for the baseline years.

**land subsidence**
The lowering of the natural land surface in response to a lower groundwater level. Caused by removal of groundwater and subsequent consolidation of certain soil types.

**contaminant plume**
An elongated body of groundwater containing contaminants that originate and migrate from a source within subsurface rocks or deposits.

# *Sustainable Yield (cont'd)*

*Water Forum 2030 solution:*

1. Increase water conservation from 8 percent to 25.6 percent (see page 2-23) with full implementation of Urban Best Management Practices (BMP).
2. Maximize surface water when available.
3. Use groundwater in dry years but not in excess of the sustainable yield over the long term (i.e., promote conjunctive use).

*Water Forum sustainable yield recommendation:*

1. Baseline condition for 2005 --- 273,000 acre-feet/year.

*Conditions that could require review of the sustainable yield recommendation by a locally determined and controlled agency or authority overseeing groundwater use in the Central Basin:*

1. Cumulative impacts of groundwater contamination and remediation.
2. Impacts of groundwater pumping on the Cosumnes River.

**BMP**
best management practices
Policies, rules, or regulations that result in greater efficiency or benefits.

**contamination (water)**
The addition to water of any substance or property preventing the use or reducing the usability of the water.

**remediation (groundwater)**
"Cleanup" of contaminated groundwater by a variety of methods.

# Zone 40

## What is "Zone 40"?

**Zone 40**
A zone in Sacramento County created by the SCWA to develop a conjunctive use program for protecting the long-term viability of Central Basin groundwater.

**SCWA**
Sacramento County Water Agency
County agency responsible for water supply planning.

Zone 40 was created in May 1985 by Sacramento County Water Agency Resolution No. 663, which defined the boundaries of the zone; these boundaries were expanded in 1999 to reflect the area shown in **Figure 15**. The Sacramento County Water Agency (SCWA) identified Zone 40's purpose as the "acquisition, construction, maintenance, and operation of facilities for the production, conservation, transmittal, distribution, and sale of ground or surface water or both for the present and future beneficial use of the lands or inhabitants within the zone." To achieve this purpose, Zone 40 is implementing a conjunctive use program that will assist in protecting the long-term viability of Central Basin groundwater. Implementing conjunctive use is also a requirement of the

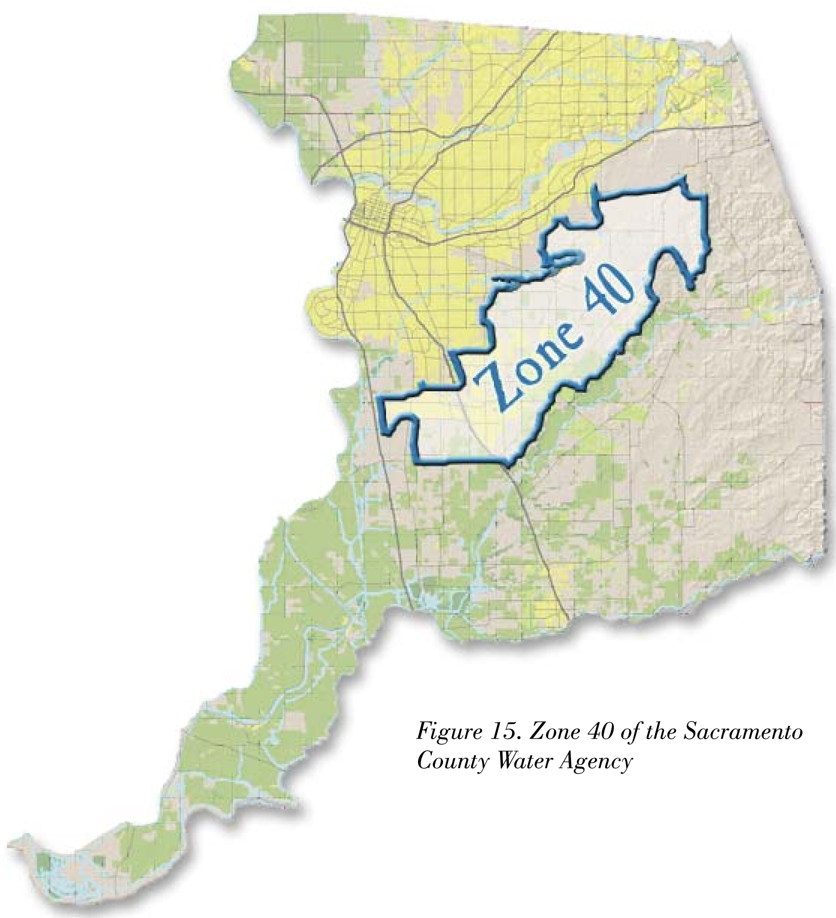



*Figure 15. Zone 40 of the Sacramento County Water Agency*

# *Zone 40 (cont'd)*

Water Forum Agreement. Therefore, SCWA plans to use 78,000 acre-feet of long-term surface water supplies from the following sources:

- SCWA has secured a long-term contract for 15,000 acre-feet of Central Valley Project (CVP) water under the authorization of Public Law 101-514 (Fazio water).
- Up to 30,000 acre-feet of CVP contract water will be transferred from the Sacramento Metropolitan Utility District (SMUD) to SCWA, in accordance with the Water Forum Agreement. A Draft Environmental Impact Report (DEIR) is currently out for public comment.
- An additional intermittent surface water supply of 33,000 acre-feet has been planned by SCWA; this supply will be used in "wet years" when Sacramento-San Joaquin Delta needs have been met. Also called "excess water," this supply is appropriated water in excess of the amount required to maintain the Sacramento-San Joaquin Delta in balance. SCWA has a pending application at the State Water Resources Control Board for this allotment.

*Summary of Surface Water Supplies*

| Source | Amount (acre-feet/year) |
|---|---|
| Fazio | 15,000 |
| SMUD | 30,000 |
| Intermittent | 33,000 |
| Total | 78,000 |

Also, SCWA will purchase 9,300 acre-feet of water from the City of Sacramento for use in the portion of Zone 40 that lies within the city's American River place of use (POU).

Conveyance of long-term water supplies is occurring, in part, through a "wheeling agreement" between SCWA and the City of Sacramento. The City diverts and treats a portion of SCWA's CVP water at the City's Sacramento River Water Treatment Plant and delivers it to SCWA's Franklin Intertie on Franklin Boulevard near the Sacramento Regional Wastewater Treatment Plant. The maximum capacity of the wheeling agreement is 11 million gallons per day (mgd). In 2002, the City wheeled approximately 4,500 acre-feet to SCWA for use in the Laguna area (see **Figure 12**). Under this agreement, the amount of surface water delivered to Zone 40 will increase approximately 1,000 acre-feet each year until the full wheeling agreement amount of 12,300 acre-feet (11 mgd) is reached or SCWA constructs its own diversion and treatment facility.

**CVP**
Central Valley Project
A federal construction project begun during the Depression. The CVP stores and transports surplus water from the Sacramento and San Joaquin rivers for use primarily in the Central Valley.

**Fazio water**
Permanent supply of 15,000 acre-feet of water from the CVP for Sacramento; so-named for Senator Vic Fazio, who supported legislation to obtain this supply.

**DEIR**
Draft Environmental Impact Report
Document required by the state that assesses possible impacts of a project on the environment.

**wet years**
Years with greater than average precipitation that result in more surface water in streams and rivers, and more deep percolation of water into groundwater basins.

**POU**
Place of use for City of Sacramento's American River water entitlement.

**wheeling agreement**
An agreement that allows a purveyor to divert, treat, and deliver water belonging to another purveyor.

**mgd**
Million gallons per day.

# Contamination

## Is groundwater in the Central Basin contaminated?

Groundwater contamination is a major concern for the Central Basin, within which three United States Environmental Protection Agency Superfund sites are located: Aerojet, the former Mather Air Force Base, and the Sacramento Army Depot (**Figure 16**). Another Superfund site, the former McClellan Air Force Base, is nearby in the north area subbasin. Other contaminated sites within the Central Basin include the Kiefer, Elk Grove, and Gerber landfills, an abandoned Pacific Gas and Electric (PG&E) facility on the Sacramento River, and the Southern Pacific and Union Pacific railroad yards (**Figure 16**). A number of groundwater wells near some of these sites have been shut down due to contamination. Contaminants have included solvents (TCE, PCE, and BTEX), fuels, perchlorate, N-nitrosodimethylamine (NDMA), and volatile organic compounds. A number of government regulatory agencies are participating in ongoing remediation (cleanup) efforts at these sites. However, migration of contaminants as a result of increased groundwater use within the Central Basin continues to be of concern.

To assist CSCGF, and any groundwater management entity that evolves from recommendations of CSCGF, the Water Forum Successor Effort has initiated an engineering study that will include a cumulative analysis of groundwater contamination in central Sacramento County. This study will identify potential effects of contaminant migration and develop groundwater management strategies based on study findings. Initial funding has been secured and additional funding sources for this study are being investigated.

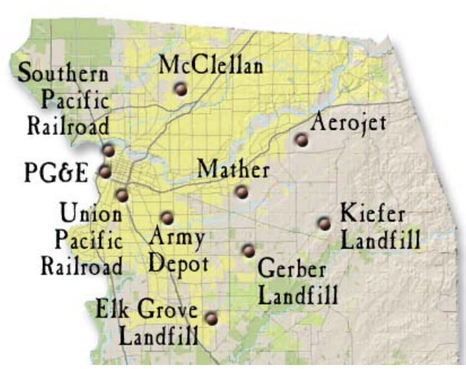



*Figure 16. Contaminated Sites in Sacramento County*

**TCE**
trichloroethene
Nonflammable organic compound used as a solvent and for dry cleaning and removing grease from metal.

**PCE**
perchloroethene
Colorless, odorless, nonflammable organic compound often used as a solvent in dry cleaning and for removing grease from metals.

**BTEX**
benzene, toluene, ethylbenzene, and xylene
Constituents of gasoline.

**perchlorate**
Primary ingredient in solid propellant for rockets and missiles, and is a common contaminant found in groundwater supplies in and around aerospace and military facilities.

**NDMA**
N-nitrosodimethylamine
Chemical used in production of 1,1-dimethylhydrazine for liquid rocket fuel and a variety of other industrial uses.

**volatile organic compounds**
Any carbon-based compound that volatilizes at atmospheric conditions.

# Conservation

## Can conservation benefit Central Basin groundwater?

Conservation can help meet water supply needs in the Central Basin and minimize the need for increased groundwater and surface water use. (Water conservation is one of the seven elements of the agreement). Each water purveyor who signed the Water Forum Agreement has agreed to implement water conservation BMPs, including residential meter retrofits and conservation pricing, toilet replacement programs, and citizen involvement programs. Signatories agreed to fully implement their water conservation programs by 2004. The Water Forum expects to achieve a gross water savings of 25.6 percent by 2030 (a baseline of 8.5 percent conservation was determined using 1990 water use data), assuming full implementation of all BMPs.

Agricultural water conservation is projected to increase during the 30-year planning period of the Water Forum Agreement; however, no agricultural water conservation program is currently in place. The Water Forum will negotiate the specifics of an agricultural water conservation program at a later time. (For a complete description of conservation plans, see the Water Forum Agreement, Appendix J.)

# Recycling

## Can water recycling benefit Central Basin groundwater?

The Sacramento County Regional Sanitation District's (SRCSD) water recycling program produces highly treated wastewater suitable for beneficial uses such as landscape irrigation, cooling towers, industrial reuse, etc. Such water may also be used for agricultural applications such as irrigating edible root crops. In addition, this recycled water may be used for recharging groundwater aquifers via surface spreading basins.

SRCSD has completed construction of a treatment plant that has a capacity of 5 million gallons per day (mgd) and is expandable to 10 mgd. The SRCSD program began delivering recycled water in summer 2003 for landscape irrigation in the Laguna, Laguna West, and Laguna Stonelake areas. Previously, irrigation for these areas came from treated groundwater and surface water supplies.

Treated wastewater must meet strict standards set by Title 22 of the California Code of Regulations. Furthermore, use of treated wastewater is regulated by at least five state and federal government agencies, including the California Department of Health Services and the Regional Water Quality Control Board.

Recycled water is currently used in other Sacramento Valley communities, including the City of Roseville, El Dorado Hills, and the City of Stockton.

**SRCSD**
Sacramento Regional County Sanitation District
: Agency responsible for large conveyance and treatment of wastewater within the urbanized area of Sacramento County.

**Title 22**
: Section of the California Code of Regulations that regulates water quality for a variety of uses.

**Regional Water Quality Control Board**
: State of California agency that is set up to preserve, enhance, and restore the quality of California's water resources.

# Future Studies and Projects

**What future studies and projects are scheduled for the Central Basin?**

The following groundwater studies and projects are pending in the Central Basin:

- A Zone 40 Master Plan DEIR is scheduled to be completed in late September 2003. The DEIR will address groundwater issues related to the Cosumnes River, existing contamination plumes, proposed remediation, and reuse.
- The Freeport Regional Water Project DEIR was completed in August 2003 and clearly defines the project and the yield of surface water supplies to Zone 40.
- As discussed previously, the Water Forum Successor Effort has initiated a summary and graphical depiction of groundwater contamination in the Central Basin that will help CSCGF members understand the rate of movement, location, and level of risk associated with contaminants for each site.
- SRCSD's recycling program will be expanded in 2003 and will supply recycled water for landscaping in East Franklin and Laguna Ridge areas.
- In cooperation with DWR, SCWA will conduct groundwater studies to investigate alternatives for using remediated groundwater throughout the Central Basin.